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(54) **Cleaning formulation**

(57) A liquid cleaning formulation having a pH of less than 6.0 and comprising a surface active agent, hydro-

gen peroxide, and a pH jump system which is a borate and polyhydroxy compound.

**EP 1 038 947 A2**

## Description

**[0001]** The present invention relates to liquid cleaning formulation intended particularly but not exclusively, for use in textile laundering operations.

**[0002]** It is well known that hydrogen peroxide may be incorporated in aqueous compositions intended for laundering textiles for its bleaching properties to remove stains and for its disinfection properties for which purpose it is effective at alkaline pH. However hydrogen peroxide is most stable in aqueous solutions at pH values less than 7 (ideally less than 6). Clearly therefore there is a "conflict" between the pH requirements for storage stability and for use.

**[0003]** It is an object of the present invention to obviate or mitigate the above mentioned disadvantage.

**[0004]** According to the present invention there is provided a liquid cleaning and bleaching formulation having a pH of less than 6.0 and comprising a surface active agent, hydrogen peroxide, and a pH jump system which is a complex of a borate and polyhydroxy compound.

**[0005]** The invention thus provides an acidic or nearly neutral cleaning and bleaching formulation. The formulation of the invention is such that, on dissolution in water (e.g. in a wash liquor) the complex comprised of the borate and the polyhydroxy compound dissociates causes an increase in pH, e.g. such that the resulting solution has a pH of at least 7, which is more suitable for hydrogen peroxide to exert its bleaching effect. Preferably the pH on dissolution in water is greater than 8, and more preferably greater than 8.5. Consequently the formulation of the invention has storage stability (by virtue of the pH of the formulation being less than 6.0) but provides good bleaching properties on dissolution in water.

**[0006]** The formulation of the invention may be a heavy duty laundry liquid, a laundry liquid for fine fabrics, a pre-spotter liquid, a pre-soak liquid, a laundry booster or a liquid toilet cleaner.

**[0007]** The liquid of the formulations is preferably an isotropic liquid although it should be appreciated that certain formulations in accordance with the invention may comprise an isotropic liquid phase together with particulate (e.g. suspended particulate) material.

**[0008]** pH-jump systems are known and are disclosed, for example, in "Studies on Borate Esters I" (M. van Dum, A. P.G. Kieboom, and H. van Bekkum, TETRAHEDRON vol.40, n°15, p 2901-2911, 1984) and in "Studies on borate esters II" (M. van Duin, A.P.G. Kieboom, and H. van Bekkum, TETRAHEDRON vol.41, n°16, p 3411-3421, 1984).

**[0009]** To achieve the best chemical stability for the formulations of the invention, a pH of less than 6.0 is used (e.g. 4.0 to 6.0) and more preferably a pH about 5.5. Upon dilution of the compositions, the pH of the wash liquor should be greater than 7, preferably greater than 8, and more preferably greater than 8.5, in order to produce sufficient alkalinity for cleaning. The composition may be such that the desired increase in pH occurs at some dilution in the range 1 to 100g/l, most preferably a dilution in the range 1 to 10g/l, e.g. about 5g/l. The pH profile upon dilution may be achieved with a concentration of borate in the compositions between 1 to 10%, preferably 3 to 7%, e.g. about 5% w/w; and with a molecular ratio of polyhydroxycompound to borate of 1:1 to 10:1, more preferably 2:1 to 8:1, and even more preferably about 4:1 to about 8:1.

**[0010]** Examples of suitable borate sources are borax decahydrate, borax pentahydrate and ammonium diborate. It is particularly preferred that the borate source is the borax decahydrate.

**[0011]** It will be appreciated that formulations in accordance with the invention in which the pH jump system is prepared with borax may comprise (in addition to the complex of the borax and polyhydroxy compound), free borax, free polyhydroxy compound, and the complex of borax and hydrogen peroxide (i.e. sodium perborate).

**[0012]** The polyhydroxy compound is preferably one incorporating vicinal hydroxy groups. The hydroxy compound may be a polyol (e.g. sorbitol, a saccharide or a saccharide derivative) or polyhydroxycarboxylate. Examples of suitable polyols and polyhydroxycarboxylates are described in "Studies on Borate Esters. Part 5.", M. van Duin, J.A. Peters, A.P.G.Kieboom, and H. van Bekkum, J. CHEM. SOC. PERK-IN TRANS. II, 1987, p 473-478. A preferred polyol for use in the invention is sorbitol and a preferred polyhydroxycarboxylate is saccharic acid or salts thereof.

**[0013]** Preferred formulations in accordance with the invention incorporate a bleach activator.

**[0014]** It is well known that hydrogen peroxide based bleach systems give poor bleaching performances at low temperatures even at high pH. Activators have been developed to maintain acceptable bleaching performances in these conditions. Hydrogen peroxide reacts with the activator to form peracid species in alkaline wash liquor. The peracid species promotes the bleaching action. The bleaching performance is enhanced by the fast increase of the pH in the washing bath when dilution of the compositions occurs. The activator may be present in the formulation in an amount of 1% to 15% (e.g. 1% to 10%) by weight. The bleach activator may be a compound incorporating aliphatic acyl groups having two or three carbon atoms, the acetyl group being preferred. Examples of suitable activators are tetra acyl alkylene diamines, e.g. tetraacetylene diamine (TAED), and acetylated polyols such as glycerol triacylates (particularly glycerol triacetate), acetylated sugars (e.g. penta acetyl glucose, penta acetyl fructose and octa acetyl sucrose) and acetylated sugar derivatives (e.g. hexa acetyl sorbitol and hexa acetyl mannitol). Particularly preferred are hexa acetyl sorbitol and hexa acetyl mannitol which may be used in admixture, e.g. as disclosed in EP-A-0 525 239. Further examples are compounds having nitrogen atoms in the basic carbohydrate skeleton, e.g. the peracetylated form of N-

methyl glucuronamide, N-methyl glucamine and glucopyronosyl amine. TAED is also a preferred activator.

[0015] It is however well known that hydrogen peroxide and activator can react in aqueous formulation even at low pH. It is also known that activators are sensitive to water and hydrolyse in aqueous media. Thus, the perhydrolysis of the activator in the presence of hydrogen peroxide and the hydrolysis of the activator in the presence of water may occur during the storage of the compositions. It is therefore preferred that the activator is encapsulated in an encapsulating system which is able to release the activator when the formulations are used. The factor promoting that release may be the dilution itself, or the increase of the pH on dilution, or the effect of enzymes in the formulation on the encapsulating system of the activator when the encapsulated enzymes are released on dilution. The encapsulant may for example be as disclosed in WO-A-9514077 or WO-A-9816621. The encapsulant may be a film forming polymer. Such film forming polymers include acrylates, methacrylates, polyamides, celluloses, starches and their derivatives.

[0016] The bleaching system can oxidise the enzymes in the washing bath, which results in a loss of performance. Furthermore, enzyme-sensitive soils can be oxidised by the bleaching system in the washing bath. These enzyme-sensitive soils are chemically modified by that oxidation and the enzymatic mechanism of soil-degradation can be affected, resulting in a loss of performance. It is therefore preferred that the encapsulation system gives a delayed slow release of the activator so that bleaching action is delayed and starts later than the enzymatic action starts.

[0017] The formulations of the invention contain a surface active agent, preferably in an amount 1 to 50% (e.g. 10 to 30%) w/w of surfactants. These surfactants may be selected from anionic, nonionic, amphoteric or cationic surfactants. The surfactants should be non-oxidable surfactants that are stable in the presence of hydrogen peroxide. Suitable anionic surfactants are, for example, soaps, fatty acids, mixtures of soaps and fatty acids, alkyl sulfate salts, alkyl sulfonate salts, alkyl benzene sulfonate salts, alkyl ether sulfate salts, alkyldiphenyl oxide disulfonate salts. Suitable nonionic surfactants are, for example alcohol ethoxylates, amide ethoxylates, alcohol polyglycol ethers, and alkyl polyglucosides. Suitable cationic surfactants are cationic ammonium salt type compounds, cationic ammonium salts or amine oxides. Preferably, the controlled surfactant-active system is a combination of anionic and nonionic surfactants or a combination of nonionic surfactants.

[0018] It is well known that the detergency of cleaning compositions is better in an alkaline washing bath than in an acidic washing bath. This can be explained by an ionisation phenomenon of soils. For example in the case of anionic surfactants, the combination effect of the ionisation of soils and the ionisation of the anionic surfactant improves the detergency. Thus, the formulations of the invention have good washing performance due to the fact that the pH increases upon dilution of the compositions.

[0019] The formulation further contains hydrogen peroxide most preferably in an amount of 1 to 8% by weight hydrogen peroxide (expressed as 100% w/w  $H_2O_2$ ). The hydrogen peroxide may be used in a form of a 20 to 90% w/w commercial hydrogen peroxide solution.

[0020] It is particularly preferred that the formulation incorporates stabilisers to inhibit the action of transition metal ions and which may be introduced in the formulations of the invention from the raw materials used in the preparation thereof and which would degrade the hydrogen peroxide. The formulation may contain from 0.1% to 6% by weight of the hydrogen peroxide stabiliser.

[0021] At least a part of such stabilisers (e.g. 0.01% to 0.5% of the formulation) may be provided by the use of highly stabilised, commercially available hydrogen peroxide solution. Examples of highly stabilised hydrogen peroxide solution are PERALKALI from Degussa, PEROXCLEAN or C.1.X. from Solvay.

[0022] Additional stabilisers such as metal sequestrants and free radical scavengers (anti-oxidants) may also be incorporated into the formulation (to bring the total level of peroxide stabiliser to 0.1 % to 6% by weight). Examples of such stabilisers are disclosed in EP-A-0741185 (Degussa) AG. These are colloidal stannic oxides or organic stannate complexes. Further examples of stabiliser are transition metal ions sequestering agents, e.g., phosphonate compounds, ethylene-diamino-tetraacetic acid, diethylenetriaminopentaacetic acid, ethylenediaminodissuccinic acid or salts thereof. Examples of suitable phosphonates are described in EP-A-0349153 (The Clorox Company). A preferred stabiliser for use in the present invention is a phosphonate. The preferred phosphonate is diethylenetriamine-penta (methylenephosphonic acid), conventionally named D.T.P.M.A., (or one of its salts, e.g. as available under the name DEQUEST 2060 S (50% w/w from Solutia). The present formulations may contain 0.1 to 5% by weight of phosphonate.

[0023] Formulations in accordance with the invention preferably contain at least one enzyme as known for use in detergent formulations. It is well known that protease, amylase and lipase enzymes improve the cleaning performance of laundry detergent compositions on specific stains, and that cellulase enzyme can "refresh" old garments. These enzymes have their maximum stability in mildly acidic aqueous medium but give the best performances in mild alkaline aqueous medium. Consequently formulations in accordance with the invention allow the enzyme to remain stable during storage but provide for activity of the enzyme in use.

[0024] Preferred enzymes are low alkaline enzymes, e.g. ALCALASE or DURAZYM from Novo Nordisk or PROPERASE and MAXAPEM from Genencor Int.

[0025] It is however well known that enzymes are rapidly oxidised by bleach systems. For that reason, enzymes included in the formulations of the present invention are preferably encapsulated by means of a polymeric encapsulation

system which protects the enzyme against oxidation in the acidic (or nearly neutral) aqueous solution containing the hydrogen peroxide. When the formulation of the invention is diluted in a wash liquid, the increase in pH promotes swelling of the polymer leading to fast release of the enzyme. The polymer may for example be a homopolymer of an unsaturated carboxylic acid, e.g. acrylic acid or methacrylic acid. Alternatively the polymeric encapsulant system may comprise polycarboxylic acid copolymer, e.g. prepared from acrylic acid and/or methacrylic acid together with unsaturated monomers other than carboxylic acids, for example acrylic esters and/or methacrylic esters and/or acrylonitrile. Blends of polymers and copolymers may also be used. Another type of encapsulated enzyme is SAVINASE 10.0 LCC from NOVO. The stability of the capsules and the liberation of the enzyme when diluted is due to a difference of ionic strength before and after dilution.

**[0026]** The formulations may contain a builder, e.g. in an amount up to 40% by weight. Builders like phosphates salts, salts of tripolyphosphates or any other phosphates type are able to soften the wash water. The result is an increase of the cleaning performances of the compositions. Organic or mineral builders are added to the formulation or are part of the pH-jump system itself. In this last case, the pH-jump system contains a polyhydroxycarboxylate with water softening properties. Preferably, builders of the present invention are salts of tripolyphosphate (e.g. the sodium or potassium salt) or salts of saccharic acid.

**[0027]** Optionally, the compositions may contain a pH adjusting agent e.g. in an amount less than 5%, for example alkalis like NaOH, KOH,  $\text{NH}_3$ ,  $\text{Na}_2\text{CO}_3$ ,  $\text{K}_2\text{CO}_3$ , borate salts, silicate salts, phosphates salts or inorganic acids like HCl,  $\text{H}_2\text{SO}_4$ ,  $\text{H}_3\text{PO}_4$ , organic acids (citric acid, lactic acid, sulfamic acid, formic acid, dodecyl benzene sulfonic acid).. These components need to be materials with sufficient purity.

**[0028]** The compositions contain up to 100% w/w of a liquid carrier, which is water or mixture of water and organic water-miscible and/or water-soluble solvents. Examples of organic water-miscible solvents and water-soluble solvents include lower mono-alcohols or lower polyols or glycol-ethers. The water-miscible or water soluble solvent may be used in an amount up to 30% (e.g. up to 20%) by weight of the formulation.

**[0029]** The formulation of the invention preferably contains at least one free radical scavenger. Preferably, the composition contains from 0.01% to 0.5% of free radical scavengers, more preferably 0.05 to 0.1%. Examples of free radical scavengers are aromatic amine based free radical scavengers described in EP-A-0349153 assigned to The Clorox Company. Other types of stabilisers are ascorbic acid, dipicolinic acid, and 8-hydroxyquinoline. Other examples of free radicals scavengers such as hindered phenols, hindered amines and vitamin A are listed in KIRK OTHMER ENC. OF CHEM. TECH.; Anti-oxidants, vol 3, pp 424-447, under the title "Radicals Scavengers". Preferably, the free radical scavengers used in the present invention is butyl hydroxytoluene (B.H.T.).

**[0030]** The compositions may also contain minor detergents ingredients such as fragrances, dyes, opacifiers, pearling agents, rheological modifiers, and the like. Generally the total amount of such minor ingredients will be less than 5% by weight of the formulation.

**[0031]** The compositions may contain less than 5% w/w of specific detergents ingredients such as dyes, fixing agents, dyes transfer inhibition agents, softeners, fluorescent whitening agents, soils release polymers, polymeric suspending agent, de-solubilisers salts, organic solvents, solubilisers, enzyme-stability enhancers and the like.

**[0032]** The mixing method and the order of introduction of the components can be important factors to ensure chemical stability of the composition of the present invention.

**[0033]** The borate, sodium hydroxide ((or other pH modifying agent) if used) and polyhydroxy compound should be added first to ensure production of the complex giving the pH jump characteristics.

**[0034]** Moreover it is particularly preferred that the formulation incorporates hydrogen peroxide stabilisers (additional to any such stabilisers present in the hydrogen peroxide *per se*) and that, with the exception of the hydrogen peroxide and any enzymes, all components of the formulation (including the aforementioned hydrogen peroxide stabilisers) are mixed together and allowed to stand for at least 30 mins (more preferably at least 45 minutes, and ideally at least 60 minutes) before addition of the hydrogen peroxide.

**[0035]** The hydrogen peroxide should be added slowly with stirring to avoid high localised levels of pure hydrogen peroxide. Ideally, any enzyme is added more than 10 minutes after addition of the hydrogen peroxide - it is important that the enzyme does not have any contact with localised regions of high hydrogen peroxide concentration. Preferably the enzyme is subjected to a sequestering treatment prior to addition to ensure hydrogen peroxide stability.

#### EXAMPLE 1

**[0036]** A heavy duty laundry liquid (with controlled pH-jump system), of the following composition (in which the amounts are in parts by weight) was prepared using the procedure described below.

Demineralised water	39.28
Borax Decahydrate	5.00

(continued)

	NaOH, high purity	1.20
	Sorbitol, 99%	15.00
5	Aromox BW220 30%(1)	8.33
	LUTENSOL AO 7(2)	12.50
	LUTENSOL AO 3 (3)	5.00
	IrganoxL134 (4)	0.05
10	Dequest 2060S(5)	0.50
	PEROXCLEAN (6)	12.14
	DURAZYM 16.0L(7)	1.00

(1) C12 amine oxide surfactant (30% w/w) from Akzo surfactants.

(2) C13/C15 alcohol ethoxylate with an average of 7 ethylene oxide unit from BASF.

(3) C13/C15 alcohol ethoxylate with an average of 3 ethylene oxide unit from BASF.

(4) Amine radical free scavengers from Ciba

(5) D.T.P.M.A. 50% from Solutia

(6) Highly stabilised hydrogen peroxide solution (35 w/w of hydrogen peroxide) from Solvay-Interlox.

(7) non encapsulated liquid protease enzyme solution from Novo Nordisk.

[0037] The formulation was prepared using the following procedure.

[0038] The demineralised water was placed in a glass beaker and the borax was added as a fine powder with slow stirring. Subsequently the sodium hydroxide was added followed by the sorbitol and stirring was continued until a clear solution was obtained. Subsequently the surfactants were added followed by the Irganox and then the Dequest 2060 S. The mixture was stirred for one hour and then the hydrogen peroxide added with stirring. Subsequently the enzyme was added with stirring.

[0039] The resulting composition had a neat pH of 6.0. Upon dilution of the composition to 5 g per litre of demineralised water, the pH rose to 8.6. The stability of the hydrogen peroxide is about 100% w/w after an ageing procedure of 24 hours at 40°C; and about 80% after 6 month at room temperature.

[0040] As a modification of the above described procedure, the Irganox and surfactants may be pre-mixed to ensure good emulsification of the former.

[0041] As a further modification, the components may be pre-treated with an aqueous solution of an agent capable of sequestering transition metal ions.

## EXAMPLE 2

[0042] A laundry liquid (controlled pH-jump system) for fine fabrics was prepared using the procedure outlined below from the following components (expressed as parts by weight).

	Demineralised water	49.49
	Borax Decahydrate	5.00
	NaOH, high purity	0.87
	Sorbitol, 99%	10.50
	LUTENSOL AO 11(8)	20.00
45	Dequest 2066 (9)	1.00
	PEROXCLEAN	12.14
	DURAZYM 16.0L	1.00

(8) C13/C15 alcohol ethoxylate with an average of 11 ethylene oxide unit from BASF.

(9) D.T.P.M.A. salt 32% from Solutia

[0043] Following the procedure of Example 1, the borax was added as a fine powder to the demineralised water with slow stirring. Subsequently the sodium hydroxide was added followed by the sorbitol and stirring was continued until a clear solution obtained. The surfactants were then added followed by the Dequest 2066. The mixture was stirred for one hour and then hydrogen peroxide added with stirring. Subsequently the enzyme was added.

[0044] The resulting composition had a neat pH of 6.3. Upon dilution of the composition to 5g per litre of demineralised water, the pH rose to 8.9.

[0045] The stability of the hydrogen peroxide is about 80% w/w after an ageing procedure of 6 weeks at 30°C. The

stability of the Durazym enzyme is about 50% w/w after an ageing procedure of 2 weeks at 30°C.

### EXAMPLE 3

- 5 **[0046]** A heavy duty laundry liquid, with controlled pH-jump system, of the following composition (expressed as parts by weight) was prepared:

10	Demineralised Water	10.45
	NaOH 50%	2.05
	Borax decahydrate	5.00
	Sorbitol; 70%	27.30
	Dodecyl benzene sulfonic acid	4.35
15	Sodium xylene sulfonate 88%	5.00
	Dow corning RD <sup>(10)</sup>	0.10
	NEODOL 25/7 <sup>(11)</sup>	10.00
	B.H.T.	0.05
	Fragrance	0.30
20	Mono ethanol amine	0.80
	Lauryl ether sulphate 2 EO, 70%	21.45
	Dequest 2060s	1.00
	C.I.X. 35% <sup>(12)</sup>	12.15

(10) Anti foam

25 (11) C12/C15 alcohol ethoxylate with an average of 7 ethylene oxide units from Shell.

(12) H<sub>2</sub>O<sub>2</sub> 35% from Solvay

- 30 **[0047]** The composition was produced using the procedure described in Example 2 by admixing all components except the hydrogen peroxide and enzyme. The mixture was stirred for one hour and the hydrogen peroxide then added with stirring. Subsequently the enzyme was added with stirring.

**[0048]** The resulting composition had a neat pH of 5.6. Upon dilution of the composition to 7.5g per litre with demineralised water, the pH rose to 8.6 and upon dilution to 3.75g per litre, the pH rose 8.8.

**[0049]** The viscosity of the neat composition was is about 375 mPa.s.

- 35 **[0050]** The chemical stability of samples stored at 37°C was as follows.

	Number of week(s)	% H <sub>2</sub> O <sub>2</sub> remaining	Neat pH
	0	100.0	5.6
	1	98.0	5.1
40	2	95.6	5.0
	4	83.9	5.1
	7	59.7(*)	4.7(*)

(\*): samples were stored at 40°C instead of 37°C.

- 45 **[0051]** The chemical stabilities of samples stored for 7 weeks at 4°C, Room Temperature: and 40°C were as follows:

	Temperature	% H <sub>2</sub> O <sub>2</sub> remaining	Neat pH	pH 7.5g/l
50	4°C	96.9	5.2	8.4
	R.T	97.1	5.2	8.4
	40°C	59.7	4.7	8.0

- 55 **[0052]** 5% w/w of coated TAED particles produced by Route C disclosed in WO-A-9816621 were added to the neat formulation. After one week at room temperature it was found that 57% of the originally added TAED remained and that the formulation had a neat pH of 4.8.

**EXAMPLE 4**

**[0053]** A heavy duty laundry liquid (with a controlled pH-jump system) of the following composition was prepared:

Demineralised Water	15.62
NaOH 50%	2.10
Borax decahydrate	5.00
Sorbitol; 70%	27.30
Dodecyl benzene sulfonic acid	13.00
Sodium xylene sulfonate 88%	5.00
Dow corning RD	0.20
NEODOL 25/7	10.00
B.H.T.	0.05
Mono ethanol amine	2.44
Lauryl ether sulphate 2 EO, 70%	7.14
Dequest 2060s	1.00
C.I.X. 35%	12.15

**[0054]** The composition was produced using the procedure described in Example 2 by admixing all components except the hydrogen peroxide and enzyme. The mixture was stirred for one hour and the hydrogen peroxide then added with stirring. Subsequently the enzyme was added with stirring.

**[0055]** The resulting composition had a neat pH of 5.6. Upon dilution of the composition to 7.5 g per litre with demineralised water, the pH rose to 8.5. An evaluation of the performance of the formulation was made using the procedure described below.

**[0056]** Wash procedures 1-3 were each carried out by washing a piece of standard test material EMPA 114 (red wine) and a piece of standard test material C.F.T BC2 (coffee) in a Miele Novotronic W715 type machine using the above formulation in conjunction with enzyme and various amounts of TAED (see below). The short washing cycle, without pre-wash, was used, the temperature was 60°C and the speed of the spin cycle was 1200rpm. The washing machine also contained 17 towels and a specific blend of other test materials as ballast.

**[0057]** Measurements were made on the samples using Minolta CM3600D spectrophotometer and the detergency was calculated as described at pages 217-218 of "Surfactant in Consumer Products" Ed. J. Fable, 1987.

**[0058]** Washing procedures 1-3 were each carried out using 150g aliquots of the above formulation which had been admixed (with stirring) with 1.5% by weight of Savinase 10 LCC enzyme. Furthermore, various amounts of TAED (see following Table) were included in a separate dosing ball in the machine. The TAED used was 99% pure ex Hoechst.

**[0059]** Comparative tests were also conducted using a commercially available washing liquid (Ariel (RTM) purchased in France) and a commercially available washing powder (Ariel purchased in France).

**[0060]** Three washes were conducted for each formulation and the results were averaged.

**[0061]** The results are shown in the following table:

Formulations	Dosage (g)	% of Savinase 10 LCC enzyme	T.A.E.D	Detergency on Empa 114	Detergency on C.F.T. BC2
Commercial Washing liquid	150,0	-	-	42,5	40,4
Wash Procedure 1	150,0	1,5	2,9	52,5	44,4
Wash Procedure 2	150,0	1,5	5,7	53,2	45,3
Wash Procedure 3	150,0	1,5	11,4	55,6	46,1
Commercial Washing powder	202,5	-	-	55,7	46,5

**[0062]** The results in the above Table demonstrate that the performance in the wash of formulations in accordance with the invention is better than that from the commercially available liquid laundry detergent and that the performance equals that of the commercially available powder, a powder being the normal way in which consumers obtain best washing performance.

Claims

1. A liquid cleaning formulation having a pH of less than 6.0 and comprising a surface active agent, hydrogen peroxide, and a pH jump system which is a borate and polyhydroxy compound.
2. A formulation as claimed in claim 1 having a pH of 5.0 to 6.0.
3. A formulation as claimed in claims 1 or 2 incorporating a bleach activator.
4. A formulation as claimed in claim 3 containing 1 to 15% by weight of the activator.
5. A formulation as claimed in claim 3 or 4 wherein the activator is TAED.
6. A formulation as claimed in any one of claims 3 to 6 wherein the activator is encapsulated.
7. A composition as claimed in any one of claims 1 to 6 comprising 1 to 10% by weight of borate and wherein the molecular ratio of polyhydroxy compound to borate is in the range 1:1 to 10:1.
8. A formulation as claimed in claim 7 wherein the ratio of polyhydroxy compound to borate is 4:1 to 8:1.
9. A formulation as claimed in any one of claims 1 to 8 wherein the borate is borax decahydrate, borax pentahydrate and ammonium diborate.
10. A formulation as claimed in any one of claims 1 to 9 wherein the polyhydroxy compound is one incorporating vicinal hydroxy groups.
11. A formulation as claimed in any one of claims 1 to 10 wherein the polyhydroxy compound is sorbitol.
12. A formulation as claimed in any one of claims 1 to 11 containing 1 to 8% by weight hydrogen peroxide (expressed as 100% w/w  $H_2O_2$ ).
13. A formulation as claimed in any one of claims 1 to 12 which contains 0.1% to 6% by weight of at least one hydrogen peroxide stabiliser.
14. A formulation as claimed in any one of claims 1 to 13 which contains 1 to 50% by weight of surface active agent.
15. A formulation as claimed in any one of claims 1 to 10 wherein the surface active agent is stable in the presence of hydrogen peroxide.
16. A formulation as claimed in any one of claims 1 to 15 wherein the surface active agent is selected from soaps, fatty acids, mixtures of soaps and fatty acids, alkyl sulfate salts, alkyl sulfonate salts, alkyl benzene sulfonates salts, alkyl ether sulfate salts, alkyldiphenyl oxide disulfonate salts, alcohol ethoxylates, amide ethoxylates, alcohol polyglycol ethers, alkyl polyglucosides, cationic ammonium salts and amine oxides.
17. A formulation as claimed in any one of claims 1 to 16 containing an enzyme.
18. A formulation as claimed in claim 13 wherein the enzyme is at least one of a protease, amylase and lipase enzyme.
19. A formulation as claimed in claim 13 or 14 wherein the enzyme is encapsulated.





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# EUROPEAN SEARCH REPORT

Application Number  
EP 00 30 0750

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	GB 2 281 744 A (PROCTER & GAMBLE COMPANY) 15 March 1995 (1995-03-15)  * page 2, line 24 - line 36 * * page 3, line 8 - page 11, line 2 * * claims 1,2,5,6,8; examples I-IV *	1,2, 7-11, 14-16	C11D3/39
X	EP 0 732 394 A (UNILEVER PLC (GB); UNILEVER N.V. (NL)) 18 September 1996 (1996-09-18) * page 3, line 33 - line 51 * * page 4, line 49 - page 5, line 8 * * claim 10; example 13 *	1,2, 7-11, 14-18	
X	US 4 992 194 A (LEVERS BROTHERS COMPANY) 12 February 1991 (1991-02-12)  * column 2, line 50 - column 3, line 10 * * column 3, line 14 - column 4, line 7 * * column 9, line 40 - column 11, line 62 * * column 12, line 59 - column 13, line 44 * * claims 1,5-7,9; examples 1,5 *	1,2, 7-11, 13-17	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			C11D
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 8 November 2001	Examiner Diebold, A
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons &amp; : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
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08-11-2001

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